

# SEQUENCE LISTING

<110> E. I. du Pont de Nemours and Company

<120> Genes Encoding Sulfate Assimilation Proteins

<130> BB-1167-B

<140>

<141>

<150> 60/092,833

<151> 1998-07-14

<160> 14

<170> Microsoft Office 97

<210> 1

<211> 890

<212> DNA

<213> Zea mays

<400> 1

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ccgtcgggaa atcgacgaac atcctgtggc atgagtgcgc catcgggcag aaggagcgac 120
agggctctgct gaaccagaag ggctgcgctg tgtggatcac tggcctaagc gggttcaggga 180
aaagcacgct cgcgtgcgcg ctgagccgcg agctgcacgg cagaggccac ctcacgtacg 240
tcctcgacgg cgacaacctc aggcacgggc tgaacaggga cctcagcttc ggagcagagg 300
accgcgccga gaacatccgc agagtggggg aagtagcgaa gctgttcgcc gacgctggcc 360
tcgtctgcat cgccagcctc atatcgccct acagaagcga ccgaagcgcg tgtcgcgatc 420
tgctgcccac gcaactcgtt atcgaggtgt tcctggacgt gccgcttcaa gtgtgcgaag 480
ccagggaccc caaaggcctc tacaagctcg cacgcgccgg caaaatcaaa gggttcaccg 540
gcatcgacga tccttacgaa ccgccgtcgg actgtgagat agtgatccag tgtaaagtcg 600
gcgactgccc ttgcctgaa tcgatggctg gtcacgttgt gtcgtacctt gagacgaatg 660
gtttcctcca ggactagaca tggaatgcga tcgatgcgtc tgatgtgtat atatgtagca 720
gcagccggag cggcattgcc aaggctgtgt aatctcatgg ctgtctttct ctttaagacc 780
aaaacaaaca agagatggca gtgtaaaaag gaaaaaaaaa actgcgtctg acagagtcgc 840
tgaatcaacc atgcttctga taaaaaaaaa aaaaaaaaaa aaaaaaaaaa 890

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<210> 2

<211> 224

<212> PRT

<213> Zea mays

<400> 2

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Ser Ala Ala Ala Ala Val Ala Gly Ile Ser Ser Ser Ser Ser Ala Leu
  1                      5                      10                      15

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Val Thr Ser Thr Val Gly Lys Ser Thr Asn Ile Leu Trp His Glu Cys
      20                      25                      30

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Ala Ile Gly Gln Lys Glu Arg Gln Gly Leu Leu Asn Gln Lys Gly Cys
      35                      40                      45

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Val Val Trp Ile Thr Gly Leu Ser Gly Ser Gly Lys Ser Thr Leu Ala
      50                      55                      60

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Cys Ala Leu Ser Arg Glu Leu His Gly Arg Gly His Leu Thr Tyr Val
      65                      70                      75                      80

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<210>	4
<211>	343
<212>	PRT
<213>	Zea mays

<400> 4  
 Arg Pro Phe His Phe Ile Asn Gln Thr Glu Pro Leu Val Thr His Thr  
 1 5 10 15  
 Gln Gln Pro Pro Ser Pro Ala Pro Gly Pro Ala Ser Gln Gly Gln Arg  
 20 25 30  
 Gln Gly Asn Thr Leu Leu Ser Pro Thr Pro Thr Leu Ala Val Ile Leu  
 35 40 45  
 Val Asn Pro Gln Arg Ala Pro Pro Val Leu Pro Gly Leu Thr Pro Ser  
 50 55 60  
 Asp Ala Pro Leu Pro Ala Leu Val Ile His Gly Leu Thr Pro Arg Ser  
 65 70 75 80  
 Ser His Ser Ser Ala Gly Leu Ala Ser Asp Ser Gly Arg Arg Glu Gly  
 85 90 95  
 Glu Gly Arg Gly Ala Arg Thr His Cys His Arg Gly Ile Gly Arg Trp  
 100 105 110  
 Val Arg Arg Arg Arg Arg Asn Gly Ala Ala Pro Gly Glu Ala Pro His  
 115 120 125  
 Ser Pro Val Lys Glu Lys Pro Val Met Ser Asn Ile Gly Lys Ser Thr  
 130 135 140  
 Asn Ile Leu Trp His Asn Cys Leu Ile Gly Gln Ser Asp Arg Gln Lys  
 145 150 155 160  
 Leu Leu Gly Gln Lys Gly Cys Val Val Trp Ile Thr Gly Leu Ser Gly  
 165 170 175  
 Ser Gly Lys Ser Thr Leu Ala Cys Ala Leu Ser Arg Glu Leu His Cys  
 180 185 190  
 Arg Gly His Leu Thr Tyr Val Leu Asp Gly Asp Asn Leu Arg His Gly  
 195 200 205  
 Leu Asn Arg Asp Leu Ser Phe Lys Ala Glu Asp Arg Ala Glu Asn Ile  
 210 215 220  
 Arg Arg Val Gly Glu Val Ala Lys Leu Phe Ala Asp Ala Gly Val Ile  
 225 230 235 240  
 Cys Ile Ala Ser Leu Ile Ser Pro Tyr Arg Arg Asp Arg Asp Ala Cys  
 245 250 255  
 Arg Ala Leu Leu Pro His Ser Asn Phe Ile Glu Val Phe Ile Asp Leu  
 260 265 270  
 Pro Leu Lys Ile Cys Glu Ala Arg Asp Pro Lys Gly Leu Tyr Lys Leu  
 275 280 285  
 Ala Arg Thr Gly Lys Ile Lys Gly Phe Thr Gly Ile Asp Asp Pro Tyr  
 290 295 300

Glu Pro Pro Ile Asn Gly Glu Ile Val Ile Lys Met Lys Asp Glu Glu  
 305 310 315 320

Cys Pro Ser Pro Lys Ala Met Ala Lys Gln Val Leu Cys Tyr Leu Glu  
 325 330 335

Glu Asn Gly Tyr Leu Gln Ala  
 340

<210> 5  
 <211> 431  
 <212> DNA  
 <213> Oryza sativa

<220>  
 <221> unsure  
 <222> (48)  
 <223> n = A, C, G or T

<220>  
 <221> unsure  
 <222> (346)  
 <223> n = A, C, G or T

<220>  
 <221> unsure  
 <222> (431)  
 <223> n = A, C, G or T

<400> 5  
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 gtgccgaagg cgtccaatat cttctggcat gattgtgcag ttggccaggc tgatcggcag 120  
 aagctactga agcagaaagg ttgcgttggt tggatcacag gacttagtgg ttcaggtaaa 180  
 agtaccctgg catgcacatt agatcgagag ctccatacaa gagggaagct ttcttatggt 240  
 cttgatggtg ataatttaag acatgggttg aacaaggatc ttggctttaa ggcggaagac 300  
 cgtgctgaaa atatacgcaa agttggtgag gtagcaaagc tattcncaga tgcaagccta 360  
 gtatgcattg caagtttcaa atctccctat aagagagaac gtgagtcctg gccctgcaat 420  
 attgtcaaat n 431

<210> 6  
 <211> 118  
 <212> PRT  
 <213> Oryza sativa

<220>  
 <221> UNSURE  
 <222> (98)  
 <223> Xaa = ANY AMINO ACID

<400> 6  
 Ser Ile Val Pro Lys Ala Ser Asn Ile Phe Trp His Asp Cys Ala Val  
 1 5 10 15

Gly Gln Ala Asp Arg Gln Lys Leu Leu Lys Gln Lys Gly Cys Val Val  
 20 25 30

Trp Ile Thr Gly Leu Ser Gly Ser Gly Lys Ser Thr Leu Ala Cys Thr  
 35 40 45

Leu Asp Arg Glu Leu His Thr Arg Gly Lys Leu Ser Tyr Val Leu Asp  
 50 55 60

Gly Asp Asn Leu Arg His Gly Leu Asn Lys Asp Leu Gly Phe Lys Ala  
 65 70 75 80

Glu Asp Arg Ala Glu Asn Ile Arg Lys Val Gly Glu Val Ala Lys Leu  
 85 90 95

Phe Xaa Asp Ala Ser Leu Val Cys Ile Ala Ser Phe Lys Ser Pro Tyr  
 100 105 110

Lys Arg Glu Arg Glu Ser  
 115

<210> 7  
 <211> 936  
 <212> DNA  
 <213> Glycine max

<400> .7  
 gcacgagcca ccgcgaaggc tctgcgacag ccctgctacg ccggaatctt tcgcaacatc 60  
 gaatgcggcc cgtcgccggc ggcgagatcg ctagggtttc cgaagctccg cggaatcaac 120  
 gtcactggat tgcactgcgg ccgccgaggc ctcgtcctcg tcctccgtgc aaaatcaaag 180  
 ccgattaggg cgaaggagaa cgcaagcgta agtgcttctc tgatcgatga ctgggttcaag 240  
 ccaattacgg cgaaggagga ttctaacgca gaggaccgta catcttcggt ttctggtaaa 300  
 aatctcaccc agatgtcaaa tgttgggaac tcgacaaaca ttatgtggca tgactgtcca 360  
 attcagaaac aagatagaca gcagctgctt cagcaacaag gctgtgttat atggctaact 420  
 ggctcagcg gatcaggaaa aagcactatt gcatgtgctc tgagtcaaag cttgcactcc 480  
 aaaggaaaac tgtcttacat ccttgatggt gacaatattc ggcatgggtc aaaccaggat 540  
 cttagtttta gagcagaaga tcgttctgaa aacattagaa ggattgggtga ggtggcaaaa 600  
 ctctttgcag atgctggtgt tatttgcac actagtttta tatcaccata ccaaaaggat 660  
 agagatgcat gcagagcact actttcaaaa ggagatttta ttgaggtttt catagatgtt 720  
 ccactacatg tgtgtgaagc tagggaccca aagggactct acaagcttgc tcgagctgga 780  
 aagatcaaag gtttctactg tatagatgat ccatatgaac caccgtgtag ttgtgagata 840  
 gtattacaac agaaaggaag tgactgtaag tctcccagtg atatggctga agaagtgata 900  
 tcctacttgg aggagaacgg atacctgcgg gcttga 936

<210> 8  
 <211> 311  
 <212> PRT  
 <213> Glycine max

<400> 8  
 Ala Arg Ala Thr Ala Lys Ala Leu Arg Gln Pro Cys Tyr Ala Gly Ile  
 1 5 10 15

Phe Arg Asn Ile Glu Cys Gly Pro Ser Pro Ala Ala Glu Ser Leu Gly  
 20 25 30

Phe Pro Lys Leu Arg Gly Ile Asn Val Thr Gly Leu His Cys Gly Arg  
 35 40 45

Arg Gly Leu Val Leu Val Leu Arg Ala Lys Ser Lys Pro Ile Arg Ala  
 50 55 60

Lys Glu Asn Ala Ser Val Ser Ala Ser Leu Ile Asp Asp Trp Phe Lys  
 65 70 75 80

Pro Ile Thr Ala Lys Glu Asp Ser Asn Ala Glu Asp Arg Thr Ser Ser



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ttactggaat tgatgatcct tatgaagcac cttctgactg cgagatagtg atacagtgca 660
aagctgggtga ctgcgccacg cctaaatcga tggctgatca agttgtgtca tatcttgaag 720
caaatgagtt cttacaggaa tagagacgta tgctatggat gaaaaaacat tctgaaattg 780
gatcgccaag ggatgtgaaa tatgaggtag tatttatgtc tagaaagagt gatgatagta 840
tgagaacata tatattgaca taaagatcga atctgtacat cattataata aattgaaatg 900
ttttgacgca aaaaaaaaaa aaaaaaaaaa 928

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<210> 10
<211> 246
<212> PRT
<213> Triticum aestivum

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```

<400> 10
Thr Arg Ala Asp Ala Gly Glu Arg Met Ala Gly Ser Glu Ala Val Pro
  1             5             10             15

Val Val Ala Val Ala Ala Gly Lys Gln Pro Val Asn Gly Ser Ala Met
      20             25             30

Ala Gly Ile Asp Lys Leu Val Thr Ser Thr Val Gly Lys Ser Thr Asn
      35             40             45

Val Leu Trp His Asp Cys Pro Ile Gly Gln Phe Glu Arg Gln Glu Leu
      50             55             60

Leu Asn Gln Lys Gly Cys Val Val Trp Ile Thr Gly Leu Ser Gly Ser
      65             70             75             80

Gly Lys Ser Thr Leu Ala Cys Ala Leu Ser Arg Glu Leu His Ser Arg
      85             90             95

Gly His Leu Thr Tyr Ile Leu Asp Gly Asp Asn Leu Arg His Gly Leu
      100            105            110

Asn Arg Asp Leu Cys Phe Glu Ala Lys Asp Arg Ala Glu Asn Ile Arg
      115            120            125

Arg Val Gly Glu Val Ala Lys Leu Phe Ala Asp Ala Gly Leu Ile Cys
      130            135            140

Ile Ala Ser Leu Ile Ser Pro Tyr Arg Ser Glu Arg Ser Ala Cys Arg
      145            150            155            160

Lys Leu Leu His Asn Ser Thr Phe Ile Glu Val Phe Leu Asn Val Pro
      165            170            175

Leu Glu Val Cys Glu Ala Arg Asp Pro Lys Gly Leu Tyr Lys Leu Ala
      180            185            190

Arg Ala Gly Lys Ile Lys Gly Phe Thr Gly Ile Asp Asp Pro Tyr Glu
      195            200            205

Ala Pro Ser Asp Cys Glu Ile Val Ile Gln Cys Lys Ala Gly Asp Cys
      210            215            220

Ala Thr Pro Lys Ser Met Ala Asp Gln Val Val Ser Tyr Leu Glu Ala
      225            230            235            240

Asn Glu Phe Leu Gln Glu
      245

```

<210> 11  
 <211> 521  
 <212> DNA  
 <213> Triticum aestivum

<400> 11  
 gcacgaggct tgcacgcaca ggaaagatta aagggttcac cggagttgat gatccatacg 60  
 aatcaccagt gaatagtgag atagtaatta agatggaagg tggggaatgc ccttcaccga 120  
 aggcaatggc ccagcaagtt ctgtcctacc ttgagaagaa cggatatttg caggcttagc 180  
 atatatatac tccagatcca gaagattgaa cttattcttc tgtgtccata actcatggac 240  
 acaggcatga tccatttggc cgcattccga ataaaaggcg ctgttattga agcaacaagc 300  
 tgcctttttc acggggaaaag ggacgcagat cgatgatcag tttgattggt cggcattgct 360  
 cctctcgcgc gtgttgtgct atttttagctg tagtctatac ttgctcattt cggctgaaat 420  
 ggtgtgctgt gctgtgctgt gtttatttgt tggtaatgta tgatttgatt gtgggtgtca 480  
 aaagtacgaa tgaataaatc gtgcttgcgt tttcaaaaaa a 521

<210> 12  
 <211> 58  
 <212> PRT  
 <213> Triticum aestivum

<400> 12  
 Thr Arg Leu Ala Arg Thr Gly Lys Ile Lys Gly Phe Thr Gly Val Asp  
 1 5 10 15  
 Asp Pro Tyr Glu Ser Pro Val Asn Ser Glu Ile Val Ile Lys Met Glu  
 20 25 30  
 Gly Gly Glu Cys Pro Ser Pro Lys Ala Met Ala Gln Gln Val Leu Ser  
 35 40 45  
 Tyr Leu Glu Lys Asn Gly Tyr Leu Gln Ala  
 50 55

<210> 13  
 <211> 312  
 <212> PRT  
 <213> Catharanthus roseus

<400> 13  
 Met Ile Gly Ser Val Lys Arg Pro Val Val Ser Cys Val Leu Pro Glu  
 1 5 10 15  
 Phe Asp Phe Thr Glu Ser Thr Gly Leu Gly Lys Lys Ser Ser Ser Val  
 20 25 30  
 Lys Leu Pro Val Asn Phe Gly Ala Phe Gly Ser Gly Gly Gly Glu Val  
 35 40 45  
 Lys Leu Gly Phe Leu Ala Pro Ile Lys Ala Thr Glu Gly Ser Lys Thr  
 50 55 60  
 Ser Ser Phe Gln Val Asn Gly Lys Val Asp Asn Phe Arg His Leu Gln  
 65 70 75 80  
 Pro Ser Asp Cys Asn Ser Asn Ser Asp Ser Ser Leu Asn Asn Cys Asn  
 85 90 95  
 Gly Phe Pro Gly Lys Lys Ile Leu Gln Thr Thr Thr Val Gly Asn Ser



100					105					110					
Thr	Asn	Ile	Leu	Trp	His	Lys	Cys	Ala	Val	Glu	Lys	Ser	Glu	Arg	Gln
	115						120					125			
Glu	Pro	Leu	Gln	Gln	Arg	Gly	Cys	Val	Ile	Trp	Ile	Thr	Gly	Leu	Ser
	130					135					140				
Gly	Ser	Gly	Lys	Ser	Thr	Leu	Ala	Cys	Ala	Leu	Ser	Arg	Gly	Leu	His
	145					150					155				160
Ala	Lys	Gly	Lys	Leu	Thr	Tyr	Ile	Leu	Asp	Gly	Asp	Asn	Val	Arg	His
				165					170					175	
Gly	Leu	Asn	Ser	Asp	Leu	Ser	Phe	Lys	Ala	Glu	Asp	Arg	Ala	Glu	Asn
			180					185					190		
Ile	Arg	Arg	Ile	Gly	Glu	Val	Ala	Lys	Leu	Phe	Ala	Asp	Ala	Gly	Val
		195					200					205			
Ile	Cys	Ile	Ala	Ser	Leu	Ile	Ser	Pro	Tyr	Arg	Lys	Pro	Pro	Asp	Ala
	210					215					220				
Cys	Arg	Ser	Leu	Leu	Pro	Glu	Gly	Asp	Phe	Ile	Glu	Val	Phe	Met	Asp
	225					230					235				240
Val	Pro	Leu	Lys	Val	Cys	Glu	Ala	Arg	Asp	Pro	Lys	Gly	Leu	Tyr	Lys
				245					250					255	
Leu	Ala	Arg	Ala	Gly	Lys	Ile	Lys	Gly	Phe	Thr	Gly	Ile	Asp	Asp	Pro
			260					265					270		
Tyr	Glu	Pro	Pro	Leu	Lys	Ser	Glu	Ile	Val	Leu	His	Gln	Lys	Leu	Gly
		275					280					285			
Met	Cys	Asp	Ser	Pro	Cys	Asp	Leu	Ala	Asp	Ile	Val	Ile	Ser	Tyr	Leu
	290					295					300				
Glu	Glu	Asn	Gly	Tyr	Leu	Lys	Ala								
	305					310									

<210> 14  
 <211> 276  
 <212> PRT  
 <213> Arabidopsis thaliana

<400> 14  
 Met Ile Ala Ala Gly Ala Lys Ser Leu Leu Gly Leu Ser Met Ala Ser  
 1 5 10 15  
 Pro Lys Gly Ile Phe Asp Ser Asn Ser Met Ser Asn Ser Arg Ser Val  
 20 25 30  
 Val Val Val Arg Ala Cys Val Ser Met Asp Gly Ser Gln Thr Leu Ser  
 35 40 45  
 His Asn Lys Asn Gly Ser Ile Pro Glu Val Lys Ser Ile Asn Gly His  
 50 55 60  
 Thr Gly Gln Lys Gln Gly Pro Leu Ser Thr Val Gly Asn Ser Thr Asn

65		70		75		80									
Ile	Lys	Trp	His	Glu	Cys	Ser	Val	Glu	Lys	Val	Asp	Arg	Gln	Arg	Leu
			85						90					95	
Leu	Asp	Gln	Lys	Gly	Cys	Val	Ile	Trp	Val	Thr	Gly	Leu	Ser	Gly	Ser
		100						105					110		
Gly	Lys	Ser	Thr	Leu	Ala	Cys	Ala	Leu	Asn	Gln	Met	Leu	Tyr	Gln	Lys
		115					120					125			
Gly	Lys	Leu	Cys	Tyr	Ile	Leu	Asp	Gly	Asp	Asn	Val	Arg	His	Gly	Leu
	130					135					140				
Asn	Arg	Asp	Leu	Ser	Phe	Lys	Ala	Glu	Asp	Arg	Ala	Glu	Asn	Ile	Arg
145					150					155					160
Arg	Val	Gly	Glu	Val	Ala	Lys	Leu	Phe	Ala	Asp	Ala	Gly	Ile	Ile	Cys
			165					170						175	
Ile	Ala	Ser	Leu	Ile	Ser	Pro	Tyr	Arg	Thr	Asp	Arg	Asp	Ala	Cys	Arg
		180						185					190		
Ser	Leu	Leu	Pro	Glu	Gly	Asp	Phe	Val	Glu	Val	Phe	Met	Asp	Val	Pro
	195						200					205			
Leu	Ser	Val	Cys	Glu	Ala	Arg	Asp	Pro	Lys	Gly	Leu	Tyr	Lys	Leu	Ala
	210					215					220				
Arg	Ala	Gly	Lys	Ile	Lys	Gly	Phe	Thr	Gly	Ile	Asp	Asp	Pro	Tyr	Glu
225					230					235					240
Pro	Pro	Leu	Asn	Cys	Glu	Ile	Ser	Leu	Gly	Arg	Glu	Gly	Gly	Thr	Ser
			245						250					255	
Pro	Ile	Glu	Met	Ala	Glu	Lys	Val	Val	Gly	Tyr	Leu	Asp	Asn	Lys	Gly
		260						265					270		
Tyr	Leu	Gln	Ala												
		275													